

Figure 3-19. Styles of cleated panel boxes.

Table 3-12. Comparison of cleated panel boxes.

Items of comparison	Cleated plywood (PPP-B-601)	Paper overlaid veneer (PPP-B-576)
Styles.....	A, B, I and J.....	A and B
Class of use.....	domestic and overseas.....	1 and 2
Styles, oversea.....	A, B, I and J.....	A and B
Styles, domestic.....	A, B, I and J.....	A and B
Weight limit vs. styles Oversea.....	A, B, I and J 1,000#.....	A and B - 350#
Domestic.....	A, B, I and J 1,000#.....	A and B - 400#
Types of loads vs. weight..	1, 2 and 3.....	Type 1 - 2 Domestic 400# Type 3 - Domestic 300# Type 1 - 2 Overseas 350# Type 3 - Overseas 250#
Unsupported span for intermediate cleats, maximum	Type 1 and 2 loads - 24"..... Type 3 load - 20".....	Type 3 load, Class 2 use - 20" All other - 24"
Size limit Oversea.....	No size limit.....	No size limit
Domestic.....	No size limit.....	No size limit
Strapping Styles A and B.....	2 lengthwise straps, and strap over all intermediate cleats, except cleats located on ends of plywood containers	All class 2 boxes and Class 1 when over 150#
Styles C thru K.....	Consult Appendix of Specification	
Staples.....	4" maximum from corners, approximately 6" apart thereafter (except over bands on bottom of box for plywood)	

Table 3-13. Plywood PS-1 and PS-51, commercial standards.

Box type	PS-51	PS-1
Domestic.....	Type III, grade 3-4 veneers.....	C-D
Overseas.....	Type I, grade 3-4 veneers.....	C-D, with exterior

¹Plywood is furnished unsanded. If smooth finish or snaded panels are required, appropriated sanded grades should be specified in the contract or order.

²End grain butt joints shall be prohibited for grade 4 veneers.

CLEATED PLYWOOD BOXES (PPP-B-601)

CONSTRUCTION OF PANELS

Plywood will conform to the minimum commercial standard grades in table 3-13. Plywood for domestic boxes will conform to HPMA-HP 1983, Type III, Grade 3-4, and PS-1, standard interior. Plywood for oversea boxes will conform to HPMA-AP 1983, Type I, Grade 3-4, and PS-1, standard interior with exterior glue (see tables 3-14, 3-15). If it is known that the boxes will not be exposed to the weather during storage and handling to its final oversea destination, plywood as specified for domestic type boxes should be specified. Cleated-plywood boxes are classified as Grade A, with preservative treatment, and Grade B, without preservative treatment. Plywood and cleats for Grade A boxes shall be treated with water-repellant preservative conforming to the following: 2% copper Maphthenate, 3% zinc naphthenate, and 1.8% copper-8-quinolate. Treated boxes shall be dried before shipment. Shipments of subsistence and clothing shall not be made in boxes fabricated from toxic treated plywood. If smooth finish for sanded panels are required, appropriate sanded grades should be specified. The minimum thickness of the plywood and size of cleats should be as shown in tables 3-14 or 3-15, as applicable. The plywood is attached to the cleats in the following manner:

Arrange the Cleats

Each panel for styles A and B will have two through cleats and filler cleats. Position the through cleats opposite each other at the edges of the panel material; then position the filler cleats between the through cleats at the edges. Style A and B boxes may have the top panel modified. When specified, style A shall have edge cleats and filler edge cleats placed on the underside of the top panel (fig 3-20). Style B boxes are modified by providing through edge cleats only on the underside of the panel. These underside cleats shall be of the same width and thickness as the outer cleats.

Table 3-14. Domestic type, requirements for cleats and plywood (PPP-B-601).

Style of box	Weight of contents		Minimum thickness of plywood		Size of cleats ¹	
	Exceeding	Not exceeding	PS-1 (see table 3-13) ²	HPMA-HP 1983 (see table 3-13) ³	Thickness	Width
					All Wood groups (incl)	All Wood groups (Incl)
	Pounds	Pounds	Inch	Inch	Inch	Inches
A, B, I and J	0	75	5/16 ⁴ ⁶	1/8	3/4	1-3/8
A, B, I and J	75	150	5/16 ⁴ ⁶	1/8	3/4	1-3/4
A, B, I and J	150	300	5/16 ⁴ ⁶	3/16 ⁴	3/4	1-3/4
A, B, I and J	300	500	5/16 ⁶	3/16	3/4	1-3/4
A, B, I and J	500	800	5/16	1/4	3/4	2-1/4
A, B, I and J	800	1000	3/8	5/16	3/4	2-5/8

¹At no place shall the actual thickness be less than the required thickness, minus 1/16 inch, nor the actual width be less than the required width, minus 1/4 inch.

²Alternatively low density wood plywood conforming to HPMA-HP 1983 (table 3-13) may be used.

³Low density wood plywood conforming to HPMA-HP 1983 (table 3-13) shall not be used.

⁴3/30 minimum inch thick plywood conforming to type III, grade 4 of HPMA-HP 1983 may be used in place of the 5/16 inch (3/20 thick plywood is not standard thickness in HPMA-HP 1983).

⁵Except that commercial tolerance shall apply.

⁶At the option of the supplier, 1/14-inch sanded plywood may be furnished.

Table 3-15. Overseas type, requirements for cleats and plywood (PPP-B-601).

Weight of contents		Minimum thickness of plywood ⁶								Sizes of edge cleats for all groups ¹	
Exceeding	Not exceeding	Types 1 and 2 loads				Type 3 load				Thickness	Width
		PS-1 (see table 3-13) ²		HPMA-HP 1983 (see table 3-13) ³		PS-1 (see table 3-13) ²		HPMA-HP 1983 (see table 3-13) ³			
		Style		Style		Style		Style			
		A&B	I and J ⁴	A&B	I and J ⁴	A&B	I and J ^{4 7}	A&B	I and J ⁴⁷		
Pounds	Pounds	Inch	Inch	Inch	Inch	Inch	Inch	Inch	Inch	Inch	Inch
0	100	5/16 ⁸	3/8	3/16 ⁵	5/16	5/16 ⁸	3/8	3/16 ⁵	5/16	3/4	1-3/4
100	200	5/16 ⁸	3/8	3/16 ⁵	5/16	5/16 ⁸	3/8	3/16	5/16	3/4	1-3/4
200	300	5/16 ⁸	1/2	3/16	3/8	5/16	1/2	1/4	3/8	3/4	1-3/4
300	400	5/16 ⁸	1/2	3/16	3/8	5/16	1/2	1/4	3/8	3/4	1-3/4
400	500	5/16 ⁸	1/2	3/16	3/8	5/16	5/8	1/4	1/2	3/4	2-1/4
500	600	5/16	1/2	1/4	3/8	5/16	5/8	1/4	1/2	3/4	2-5/8
600	800	3/8	5/8	5/16	1/2	3/8	5/8	5/16	5/8	3/4	3-1/4
800	1000	3/8	5/8	5/16	1/2	1/2	5/8	3/8	5/8	3/4	3-1/4

¹At no place shall the actual thickness be less than the required thickness, minimum 1/16 inch, not the actual width be less than the required width, minus 1/4 inch.

²Alternatively low density wood plywood conforming to HPMA-HP 1983 (table 3-13) may be used.

³Low density wood plywood conforming to HPMA-HP 1983 (table 3-13) shall not be used.

⁴Top and bottom panels of I and J boxes only, all other panels as specified for styles A and B.

⁵Minimum 3/20 inch thick plywood conforming to type I, grade 4 of HPMA-HP 1983 may be used in place of the 3/16 inch thick plywood. (3/20 inch thick plywood is not a standard thickness in HPMA-HP 1983).

⁶Except that commercial tolerance shall apply.

⁷The maximum weight of contents for Air Force shipments for style I and shall be 150 lbs.

⁸At the option of the supplier, 1/4 inch sanded plywood may be furnished.

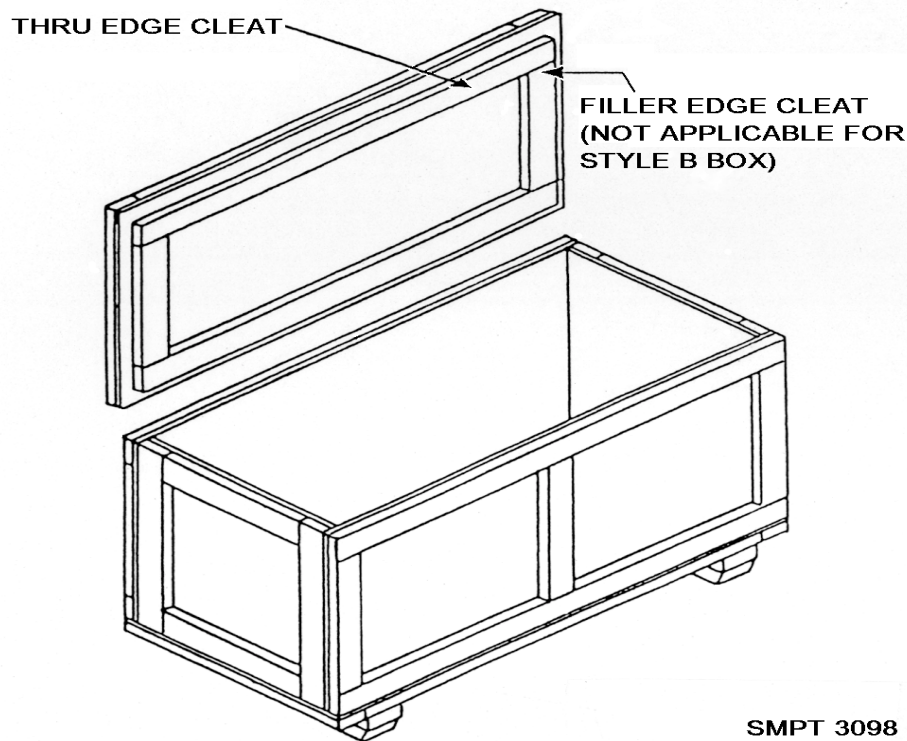


Figure 3-20. Top panel modification of unnailed closure, PPP-B-601, style A box.

Unless otherwise specified filler edge cleats shall be either the same length as the distance between the through edge cleats or approximately one-eighth inch shorter.

Filler edge cleats on top and bottom panels, except on top only when the box is provided with skids, shall be either the same length as the distance between the through edge cleats or approximately one-fourth inch shorter for oversea type boxes.

When the filler cleats are the same length as the distance between through edge cleats, each end shall be either cut at an angle or notched to provide a drainage area between the filler cleat and the plywood of approximately one-fourth inch by one-fourth inch. Drainage areas are not applicable on the underside cleats of the top panels of the unnailed closure Style A box.

Each cleat shall be a single unjointed piece.

Fasten the panel material to the cleats (fig 3-21).

Nails, staples, wire stitches, or other fasteners positioned lengthwise of a cleat are staggered in two parallel rows, approximately three-eighths inch from the edge of the cleat.

The distance between the nearest edge of a fastener and the edge of a cleat shall not be less than three-eighths of an inch and not closer than three-fourths of an inch nor more than 1 inch from the end of the cleat.

Space the nails not more than 6 inches apart lengthwise in each row. Usually, nail or staple through the plywood and then cleat and clinch. Reversal of this sequence is permitted only for nails.

Construction of Plywood Joints

In the construction of large cleated plywood boxes, it frequently becomes necessary to join sheets of panel material. Bottom panels of boxes not exceeding 72 inches in length or 48 inches in width, and top and bottom panels of Style I boxes shall consist of a single piece of plywood. All other panels shall consist of one or two pieces of plywood joined by either a lap or butt joint (see fig 3-22) as specified below. Each piece of plywood in two-piece panels shall be not less than 24 inches in length or width. Plywood joints in adjacent panels should not be closer than 12 inches of being in line.

Lap Joint

Overlap two pieces of panel material at least 3 inches. Fasten the sheet together with metal stitches through the overlap and clinch. Use not less than two parallel rows of stitches. Space stitches not less than 2 inches apart. The average spacing of stitches in each row must not exceed 4 inches. The maximum thickness of plywood to be used for this type of joint shall be 3/16 inch.

Butt Joint

Butt two pieces of plywood at the midwidth of a joint cleat. Fasten each piece of plywood to the joint cleat. The thickness of a joint cleat will be the same as an edge cleat. The width of a joint cleat for a domestic box will be no less than 2 1/4 inches. If the edge cleat is more than 2 1/4 inches wide, the joint cleat will be of the same width. For oversea type boxes, the joint cleat will be not less

than 1 1/3 times the required width of the edge cleats or never less than 2 1/4 inches.

Determine the Requirements

Additional wood cleats, of the same width and thickness as the edge cleat, are applied to an unframed area which exceeds 24 inches in any dimension or 20 inches for oversea type boxes with Type 3 loads. Additional cleats are applied to any face of a box having a load concentration near the center of the unframed area.

Fasten the Cleats

Apply cleats perpendicular to the greater of the two dimensions between edge cleats. Space and drive fastenings in the same manner as for edge cleats.

ASSEMBLY OF BOXES

Style A (Oversea)

Assembly Of The Panels

Arrange the panels so that one through cleat and one filler cleat forms each edge of the box. Arrange the cleats to form a standard box corner (fig 3-18). Arrange the top and bottom panels to overlap the sides and ends.

Nailing the Panels Together

Nail all panels to each other by single line nailing. Use either mechanically deformed, cement coated or chemically-etched nails. Space the nails in accordance with the type of load and the thickness of cleats (tables 3-16 and 17).

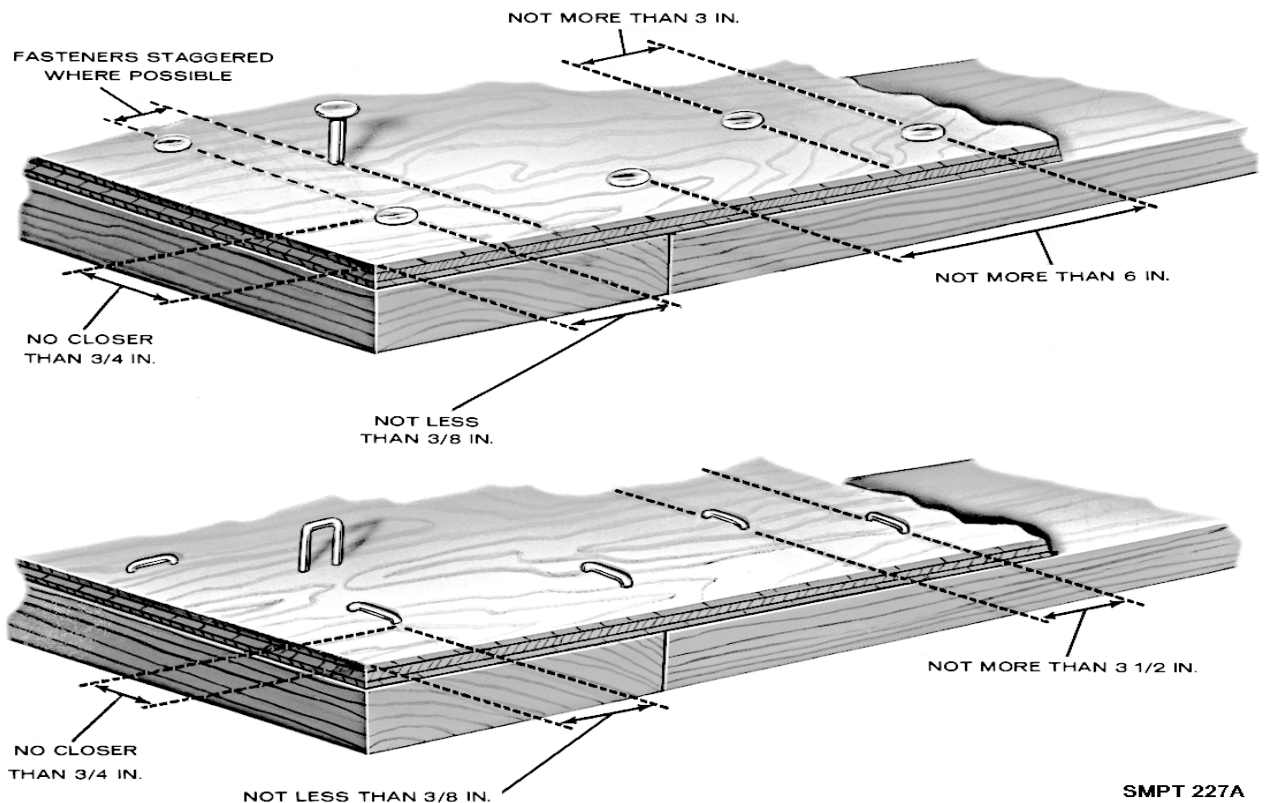


Figure 3-21. Spacing of fasteners.

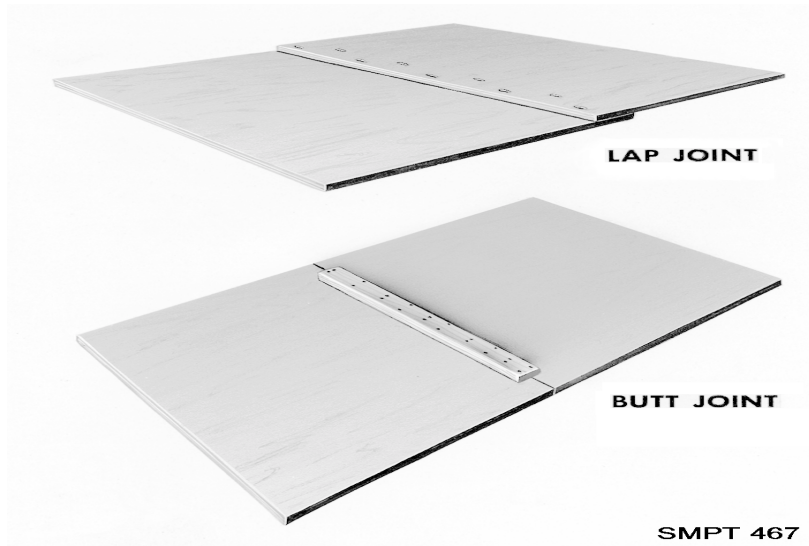


Figure 3-22. Acceptable plywood joints.

Table 3-16. Domestic type, sizes and spacing of nails for fastening together adjacent cleated panels.

Cleats Thickness	Maximum spacing of nails all wood groups		Size of nails for wood groups ¹			
	Types 1 and 2 loads	Type 3 load	I	II	III	IV
<i>Inch 3/4</i>	<i>Inches 5</i>	<i>Inches 4</i>	Penny 7	Penny 7	Penny 7	Penny 6

¹If the nail protrudes through the last edge cleat or splits cleat, then the next smaller size penny nail shall be used.

Table 3-17. Oversea type, sizes and spacing of nails for fastening together adjacent cleated panels.

Cleats, thickness (Inch)	Maximum spacing of nails, all wood groups		Size of nails for wood groups ¹			
	Types 1 and 2 loads	Type 3 load	I	II	III	IV
<i>3/4.....</i>	<i>Inches 5</i>	<i>Inches 4</i>	<i>Penny 9</i>	<i>Penny 8</i>	<i>Penny 7</i>	<i>Penny 6</i>

¹If the nail protrudes through the last edge cleat or if it splits the cleat, then the next smaller size penny nail shall be used.

Table 3-18. Diameter of round wire strapping.

Weight of contents	Diameter of wire when different numbers of wire are used								
	2 wires			3 or more wires					
	100,000 pounds per square inch tensile strength	140,000 pounds per square inch tensile strength	100,000 pounds per square inch tensile strength	100,000 pounds per square inch tensile strength	100,000 pounds per square inch tensile strength	100,000 pounds per square inch tensile strength	100,000 pounds per square inch tensile strength	100,000 pounds per square inch tensile strength	100,000 pounds per square inch tensile strength
Pounds	Inch	Inch	Inch	Inch	Inch	Inch	Inch	Inch	Inch
Up to 70, incl.....	0.0720 (15 gage)	0.0720 (15 gage)	0.0720 (15 gage)	0.0720 (15 gage)	0.0720 (15 gage)	0.0720 (15 gage)	0.0720 (15 gage)	0.0720 (15 gage)	0.0720 (15 gage)
71 to 125, incl.....	0.0800 (14 gage)	0.0720 (15 gage)	0.0720 (15 gage)	0.0800 (14 gage)	0.0800 (14 gage)	0.0800 (14 gage)	0.0800 (14 gage)	0.0800 (14 gage)	0.0800 (14 gage)
126 to 175, incl.....	0.0915 (13 gage)	0.0800 (15 gage)	0.0800 (15 gage)	0.0915 (13 gage)	0.0915 (13 gage)	0.0915 (13 gage)	0.0915 (13 gage)	0.0915 (13 gage)	0.0915 (13 gage)
176 to 250, incl.....	0.0915 (13 gage)	0.0915 (13 gage)	0.0915 (13 gage)	0.0915 (13 gage)	0.0915 (13 gage)	0.0915 (13 gage)	0.0915 (13 gage)	0.0915 (13 gage)	0.0915 (13 gage)
251 to 400, incl.....	.....	.....	.....	0.0915 (13 gage)	0.0915 (13 gage)	0.0915 (13 gage)	0.0915 (13 gage)	0.0915 (13 gage)	0.0915 (13 gage)
401 to 1,000, incl....	.....	.....	.....	0.1055 (12 gage)	0.1055 (12 gage)	0.1055 (12 gage)	0.1055 (12 gage)	0.1055 (12 gage)	0.1055 (12 gage)

Table 3-19. Size of flat metal bands

Weight of contents not exceeding	Dimension of flat metal bands when different numbers of bands are used	
	2 bands	3 or more bands
<i>Pounds</i>	<i>Inch</i>	<i>Inch</i>
Up to 70, incl.....	3/8 by 0.020	3/8 to 0.020
71 to 125, incl.....	3/8 by .020	3/8 by .202
126 to 175, incl.....	1/2 by .020	1/2 by .020
176 to 250, incl.....	5/8 by .020	5/8 by .020
251 to 400, incl.....		3/4 by .020
401 to 1000, incl.....		3/4 by .023

Table 3-20. Size of type III, twist-tied flat metal strapping

Weight of contents not exceeding	Dimensions when different numbers of bands are used	
	2 straps	3 or more straps
<i>Pounds</i>	<i>Inch</i>	<i>Inch</i>
70	0.140 by 0.031	0.138 by 0.025

Style B (oversea)

Assembly of the Panels

Arrange the panels so that one through cleat and one filler cleat forms each edge of the box. Arrange the cleats to form a 3-way interlocking corner (see fig 3-18). Arrange the top and bottom to overlap the sides; then arrange the ends to overlap the top and bottom and, finally, arrange the sides to overlap the ends.

Nailing the Panels Together

Nail each through cleat to two other through cleats at the corner with nails driven at right angles to each other. Nail the panels to each other by single line nailing. Use either mechanically deformed, cement-coated, or chemically-etched nails. Space the nails in accordance with the type of load and the thickness of the cleats (table 3-16 and 3-17).

Styles A, B, I and J (Domestic)

Four styles are available for domestic use; Styles A, B, I and J, depending on the cleat arrangement. A study of figure 3-19 shows the cleat arrangement for each style. For Styles I and J the plywood along each uncleated edge is fastened to the cleat on the adjacent panel by nails passing through the plywood and into the cleat. Nails shall not be less than 1 inch longer than the thickness of the plywood through which they pass for domestic type and 1 3/8 inches for oversea types and their spacing shall not exceed 3 inches.

Application of Skids

Unless otherwise specified, boxes with items packed therein, having a gross weight in excess of 200 pounds or length and width dimensions of 48 inches by 24 inches or more, and gross weight of 100 pounds or over, shall be provided with a minimum of two skids. The skids shall be minimum of 2 1/2 inches high and 3 1/2 inches wide. When 4-way fork entry is required, skids shall be nominal 4-by-4-inch, placed lengthwise not less than 1 1/2 inches nor more than 2 1/2 inches from the container sides and cut out a minimum of 2 inches in depth and of such width as to accommodate forks and slings for handling. Each skid shall be notched sufficiently to provide clearance for strapping. The skids shall be placed parallel to, and extend the full width of the box (the shorter of the two horizontal dimensions), and shall be set not less than 2 1/2 inches nor more than 1/6 the box length from each end. The distance between skids, measured between the inside edges, shall not exceed 48 inches. Filler cleats of the same thickness as the end cleats of the bottom panel and not less than the width of the skids shall be provided between each skid and the bottom panel of the shipping container. Additional skid(s), as required, shall be positioned so as to divide the area between the end skids into units of equal lengths. When boltholes are provided in the item, additional skids if needed shall be located so as to enable the item to be bolted to the skids. The skids shall be secured to the box by nails. The nails shall be driven through the bottom panel, the filler cleats, and the skids, and shall penetrate a minimum of three-fourths the skid, thickness. The nails shall be pallet nails having mechanically deformed shanks conforming to ASTM F 1667-95. These nails shall not protrude through the bottom surface of the skid. The nails shall be arranged in two rows in a staggered pattern, with spacing between nails in each row to be not more than 6 inches. Each row of nails shall be approximately one-half inch in from the edge of the skid and the nailing pattern shall begin and end approximately 1 1/2 inches in from the end of each skid and shall not be nailed through the strap notch.

Closure

The top panel shall be positioned and nailed. The size and spacing of nails shall be shown in tables 3-16 and 3-17. Drive nails straight to prevent them from protruding.

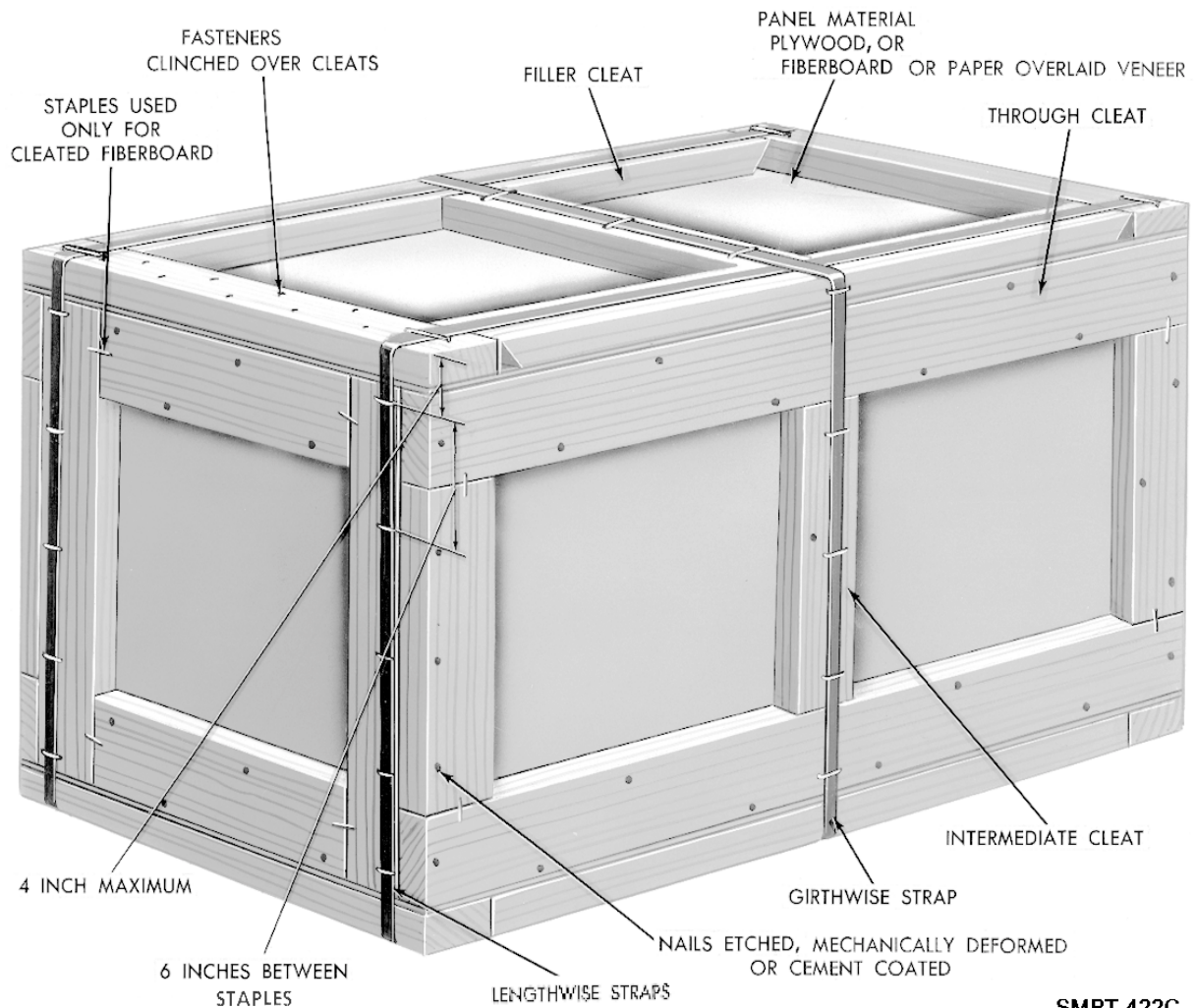
Strapping Requirements

Strapping requirements are found in the appendix to PPP-B-601. The sizes of round wire and flat metal straps are found in table 3-18, 3-19 and 3-20. Styles A or B boxes that have modified tops will be closed with flat steel strapping. Other means are prohibited.

Styles A, B, I and J (Oversea)

Strap Styles A, B, I and J, unless otherwise specified (see figure 3-23). On Styles A and B, apply two lengthwise straps on the edge cleats over the ends, top, and bottom. On Styles I and J, apply two lengthwise straps on the edge cleats over the ends and sides. Place a girthwise strap over intermediate

cleats, when required, on the sides, top and bottom (fig 3-24). Draw strapping tightly so as to sink into the edges of the cleats. Fasten strapping to the cleats with staples spaced approximately 6 inches apart, and within 4 inches from the edge of the box over which the strap passes (except over bands on the bottom of the box and bands applied over filler cleats on the top). Staples shall be applied just prior to shipment where practicable. Strapping used for unnailed closure boxes shall not be stapled. Alternately, each lengthwise and girthwise strap may be replaced by four corner straps each 8 inches long and secured to the box with three staples on each leg pneumatically driven through the strap into the cleat. However, corner straps shall not be used on unnailed closure boxes. Exercise care in strapping domestic styles so that the straps do not pass over voids between cleats and thus become susceptible to snagging.



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Figure 3-23. Strapping of cleated panel boxes.

Styles A, B, I and J (Domestic)

Strap domestic styles only where specified. Strap in accordance to the appendix to PPP-B-601.

Dimensions

Dimensions shall be given in the sequence of length, width and depth of the inside measurements. The first two dimensions will be the open face of the box. A tolerance of plus or minus 1/8 inch is permitted in the dimensions.

BOXES, WOOD-CLEATED PANELBOARD

Wood-cleated panelboard boxes are intended for use as containers for domestic and overseas equipment of general materials and supplies, not exceeding 500 pounds for domestic or 400 pounds for overseas shipments.

Wood-cleated, water-overlaid veneer boxes take all three types of loads to a maximum weight of 500 pounds for domestic use (class 1 boxes), and 400 pounds for overseas use (Class 2 boxes), in accordance with PPP-B-576. Styles A and B only are authorized for both domestic and overseas shipments. Tables 3-21 and 3-22 contain the requirements for the paper-overlaid veneer panelboard and the cleats for class 1 and 2 boxes, respectively, according to the weight of contents.

Skids are attached to the bottom of boxes having a gross weight of more than 200 pounds, or when the length and width dimensions are 48 inches by 24 inches or over and the gross weight is 100 pounds or over. The skids shall be a minimum of 2 1/2 inches high and 3 1/2 inches wide and may be fabricated from more than one piece of lumber to make up the required height. The skids shall be set not less than 2 1/2 inches not more than 4 inches in from each end. Filler cleats of the same thickness as the edge cleats and the same width as the skids and the bottom panel of the box.

**WOOD-CLEATED, SKIDDED, LOAD-BEARING BASE BOXES
(ASTM D6256)**

These boxes may be used for the shipment of items which can be secured to a load-bearing base. The sides, tops, and ends are of cleated panel construction. Panels may be plywood, fiberboard, or paper-overlaid veneer and comply with the applicable requirements of PPP-B-601 and PPP-B-576, respectively. Styles A, B, and C are used for Type I, domestic, and Type II, overseas shipments. The bases are fabricated as Class 1, plywood base, and Class 2, lumber base (see fig 3-25).

INTENDED USE

Boxes covered by ASTM D6256 are intended to be used for items which can be attached to a load-bearing base. It is intended that the entire load be carried on the base. The super-structure (tops, ends, and sides) provides only for superimposed loads and protection against the elements. It is not intended for the box to be lifted or moved other than by the base. The super-structure may be removed when it is not required.

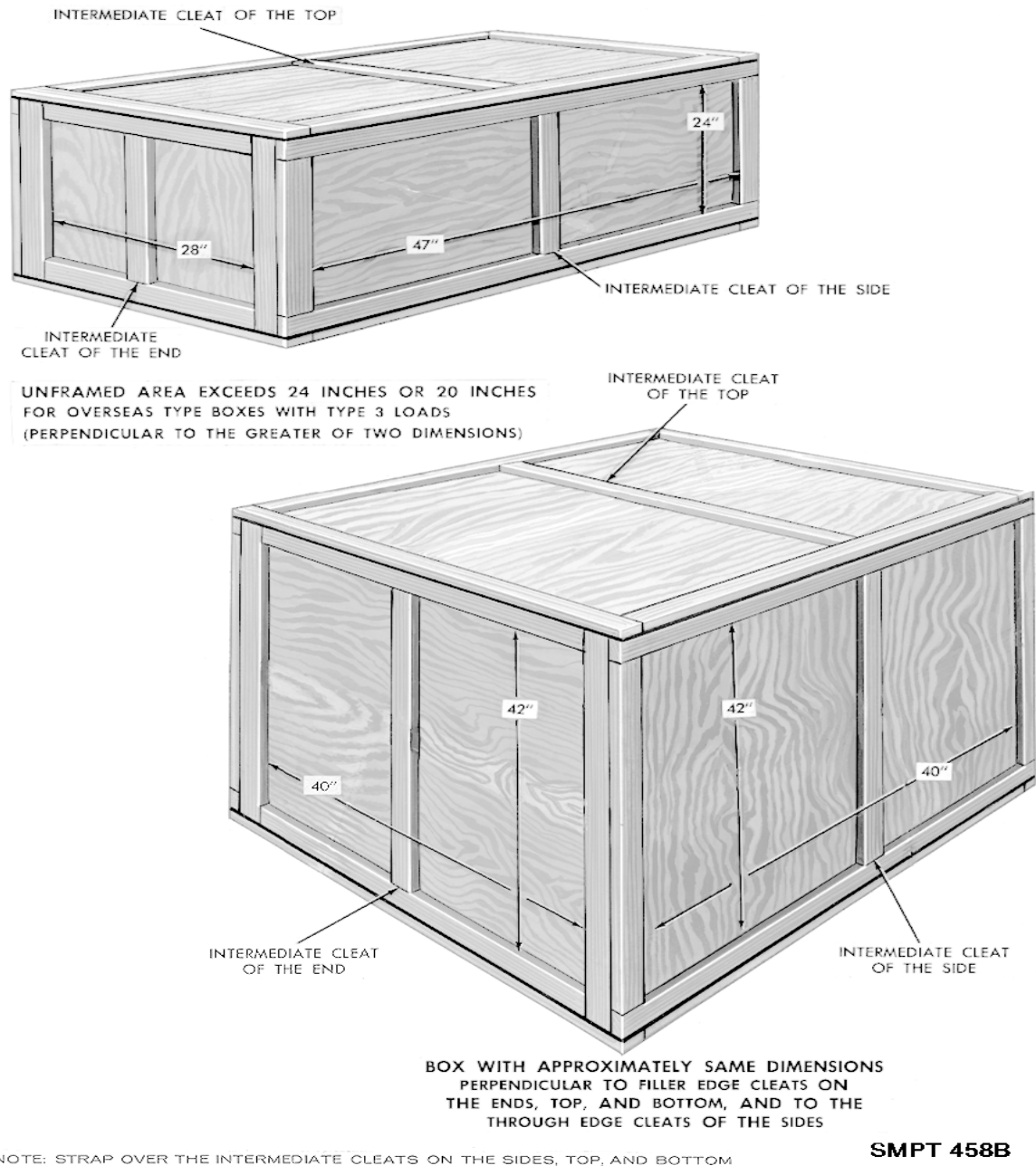
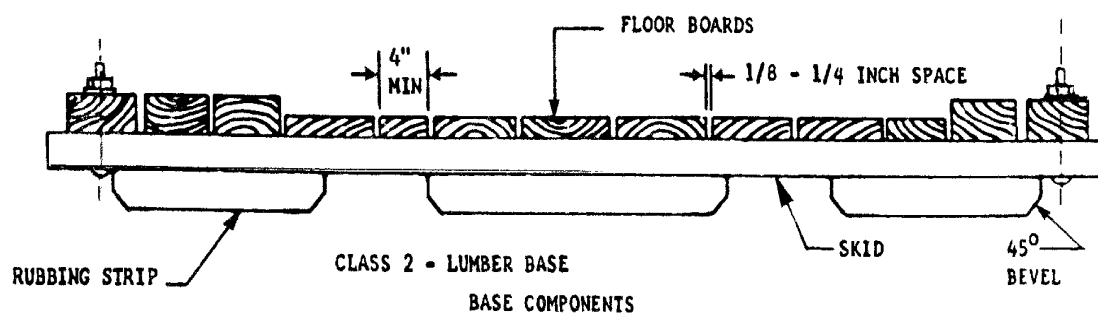
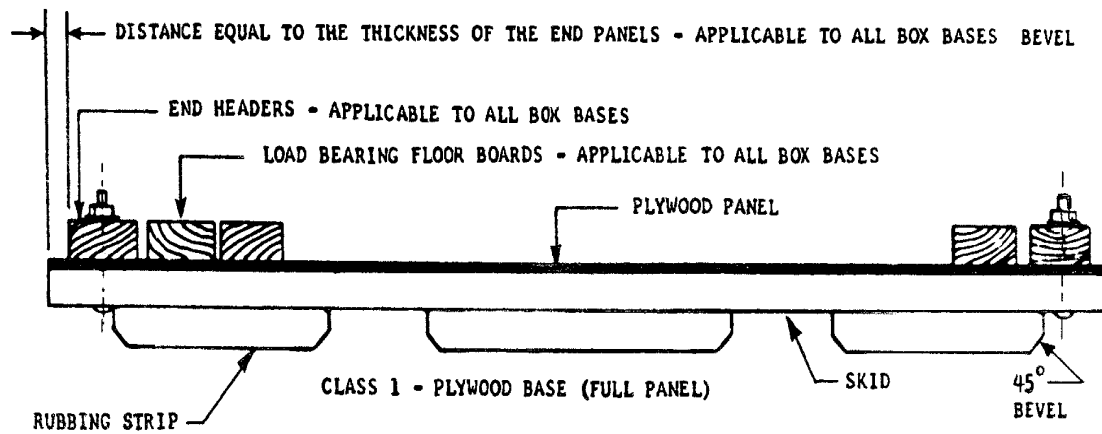
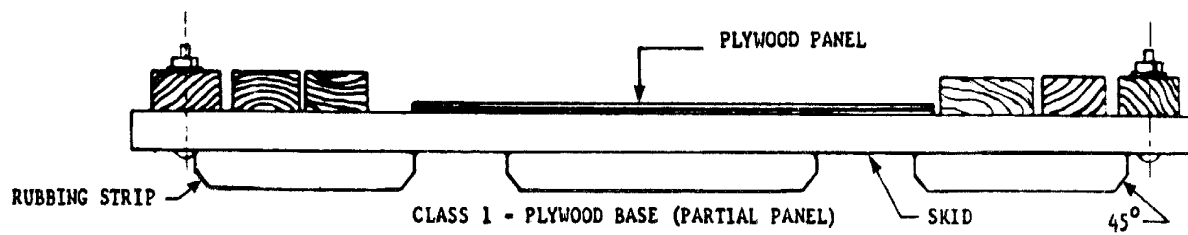


Figure 3-24. Spacing of intermediate cleats.



SMPT 461B

Figure 3-25. Classes 1 and 2 bases for wood-cleated, skidded, load-bearing base boxes, ASTM D6256.

Table 3-21. Class 1 boxes: Requirements for paper overlaid veneer panelboard and cleats

Weight contents		Size of cleats		Paper overlaid veneer panelboard	
Exceeding	Not exceeding	Minimum width	Minimum thickness	Types 1 and 2 loads	Type 3 loads
				Minimum thickness	Minimum thickness
<i>Pounds</i>	<i>Pounds</i>	<i>Inches</i>	<i>Inch</i>	<i>Inch</i>	<i>Inch</i>
0	75	1-3/8	5/8	0.070	0.090
75	150	1-3/4	5/8	0.115	0.140
150	225	1-3/4	3/4	0.115	0.140
225	300	1-3/4	3/4	0.170	0.195
300	400	1-3/4	13/16	0.225	-----

Table 3-22. Class 2 boxes: Requirements for paper overlaid veneer panelboard and cleats

Weight contents		Size of cleats		Paper overlaid veneer panelboard	
Exceeding	Not exceeding	Minimum width	Minimum thickness	Types 1 and 2 loads	Type 3 loads
				Minimum thickness	Minimum thickness
<i>Pounds</i>	<i>Pounds</i>	<i>Inches</i>	<i>Inch</i>	<i>Inch</i>	<i>Inch</i>
0	100	1-3/4	5/8	0.070	0.120
100	250	1-3/4	3/4	0.140	0.180
250	350	1-3/4	13/16	0.225	0.195

Fabrication of Panels

When panels are fabricated locally, they are made according to information contained in table 3-13 and HPMA-HP 1983. Also see PPP-B-601 construction of panels. Even filler cleat tolerance and drainage shall be in accordance with PPP-B-601. Cleat arrangement on top panels is illustrated in figure 3-26. When joists are required for the super-structure to hold superimposed loads, they are selected in accordance with table 3-23. Joist supports are required to be placed beneath each joist (see fig 3-27). The vertical and material supports shall comply with the material requirements for the cleat stock, except that the thickness shall not be less than one inch for container loads up to 1,000 pounds. For loads in excess of 1,000 pounds, the supports shall be not less than 2 inches. The vertical joist supports shall be nailed to the side panels with nails long enough to pass through the clinch of 1/8 inch for Groups II, III, and IV woods and 1/4 inch clinch for Group I woods.

Fabrication of Base Components (see fig 3-24)

Skids

Skids will be made of Group II, III, or IV lumber. The cross section and length of skids are chosen from table 3-28, based upon weight of contents and load conditions, as illustrated in figure 3-27. For boxes whose outside width exceeds 36 inches, a third skid conforming to table 3-28 is added. The third skid is placed equidistant between the outer skids. At the ends of each skid, the lower half is beveled approximately 45 degrees.

Load Bearing Members

Load bearing members will be free of defects which could materially weaken them. They are selected in accordance with table 3-25. The cross section of load bearing members for a particular load is determined either by assuming a total width of such load bearing members and determining the thickness necessary, or by assuming a thickness and determining a total width of load bearing members.

Lumber Flooring

Lumber flooring will be a minimum of 1-inch thick, and not less than 4 inches wide. Lumber is laid at right angles to the skids. The boards are separated one-eighth to one-fourth of an inch to allow for swelling and drainage. The board ends are placed flush with the outer edge of the skids.

Plywood Flooring

Unless otherwise specified, plywood used for Type I boxes shall conform to HPMA-HP 1983, Type II, Grade 3-4, PS1, standard interior. The minimum thickness shall be three-eighths of an inch. See table 3-13. It may be the full length and width of the base, or it may be a centrally located square piece with the length equal to the base width. When a full piece of plywood is used, a drainage hole one-half inch in diameter is placed in each corner of the base. Additional drainage holes are placed every three feet along the side of the base. When load bearing floorboards are placed over plywood panels, at least one drainage hole is placed on each side of the base between the load bearing floorboards.

End Headers

End headers are placed at the ends of the box. Headers are nominal 2 X 4 inches.

Rubbing Strips

When specified, rubbing strips shall be applied under each skid to facilitate forklift handling. They will provide a nominal 3-inch clearance for forklift entry.

Table 3-23. Selection of joists for wood cleated, skidded, load bearing base boxes (joists spaced 24 inches--center to center)

Nominal joist size (Inches)	Outside width of box (Inches)
None required	24
1X4	25-36
2X4	37-60

Table 3-24 . Nominal sizes and maximum lengths of skids for wood cleated,skidded, load bearing base boxes.

Weight of Contents (Pounds)	Load Condition ^{1/}	Nominal Sizes					
		2 X 4	2 X 6	2 X 8	4 X 4	4 X 6	6 X 6
		Maximum Length of Skid (Feet)					
0 - 100	A	16	--	--	--	--	--
	B	16	--	--	--	--	--
	C	16	--	--	--	--	--
	D	16	--	--	--	--	--
	E	16	--	--	--	--	--
101 - 200	A	16	--	--	--	--	--
	B	16	--	--	--	--	--
	C	16	--	--	--	--	--
	D	16	--	--	--	--	--
	E	16	--	--	--	--	--
201 - 400	A	11	15	16	--	--	--
	B	13	16	--	--	--	--
	C	8	12	16	--	--	--
	D	10	15	16	--	--	--
	E	13	16	--	--	--	--
401 - 600	A	8	11	14	16	--	--
	B	9	14	16	--	--	--
	C	5	8	11	16	--	--
	D	7	10	14	16	--	--
	E	9	14	16	--	--	--
601 - 800	A	7	9	11	16	--	--
	B	7	10	14	16	--	--
	C	4	6	8	16	--	--
	D	5	8	10	16	--	--
	E	7	10	14	16	--	--
801 - 1000	A	6	8	10	16	--	--
	B	5	8	11	16	--	--
	C	3	5	7	16	--	--
	D	4	6	8	16	--	--
	E	5	8	11	16	--	--
1001 - 1200	A	6	7	8	16	--	--
	B	4	7	9	16	--	--
	C	3	4	5	13	16	--
	D	3	5	7	16	--	--
	E	4	7	9	16	--	--
1201 - 1400	A	5	7	8	14	16	--
	B	5	6	8	16	--	--
	C	0	4	5	11	16	--
	D	3	4	6	14	16	--
	E	5	6	8	16	--	--

^{1/} The load condition is determined by the manner in which the load is applied to the skids (figure 3-27)

Table 3-24 (cont). Nominal sizes and maximum lengths of skids for wood cleated,skidded, load bearing base boxes.

Weight of Contents (Pounds)	Load Condition ¹ /	Nominal Sizes					
		2 X 4	2 X 6	2 X 8	4 X 4	4 X 6	6 X 6
		Maximum Length of Skid (Feet)					
1401 - 1600	A	5	6	7	13	16	--
	B	3	5	7	16	--	--
	C	0	3	4	18	15	16
	D	3	4	5	12	16	---
	E	3	5	7	16	--	--
1601 - 1800	A	5	6	7	12	16	--
	B	3	5	6	15	16	--
	C	0	3	4	9	14	16
	D	0	3	4	11	16	--
	E	3	5	6	15	16	--
1801 - 2000	A	4	5	6	11	15	16
	B	3	4	5	13	16	--
	C	0	0	3	8	12	16
	D	0	3	4	10	15	16
	E	3	4	5	13	16	--
2001 - 2220	A	4	5	6	10	14	16
	B	0	4	5	12	16	--
	C	0	0	3	7	11	16
	D	0	3	4	9	14	16
	E	0	4	5	12	16	--
2201 - 2400	A	4	5	6	10	13	16
	B	0	3	4	11	16	16
	C	0	0	3	7	10	16
	D	0	0	3	8	13	16
	E	0	3	4	11	16	--
2401 - 2500	A	4	5	6	9	13	16
	B	0	3	4	10	16	--
	C	0	0	3	6	10	16
	D	0	0	3	8	12	16
	E	0	3	4	10	16	--

Table 3-25. Allowable load (pounds) per inch of width of load-bearing floor members

Length between outside skids (inches)	Nominal 1-inch thick boards (lbs per inch)		Nominal 2-inch thick boards (lbs per inch)		Nominal 3-inch thick boards (lbs per inch)	
	Wood Groups		Wood Groups		Wood Groups	
	I or II	III or IV	I or II	III or IV	I or II	III or IV
12	38	46	176	211	459	551
18	26	31	118	142	306	367
24	19	23	88	106	230	276
30	15	18	70	84	183	220
36	13	16	58	70	154	185
42	11	13	52	62	131	157
48	10	12	44	53	115	138
54	9	11	39	47	102	122
60	7	8	35	42	92	110



Figure 3-26. Styles A and B cleat arrangement for wood cleated, skidded, loadbearing base boxes.

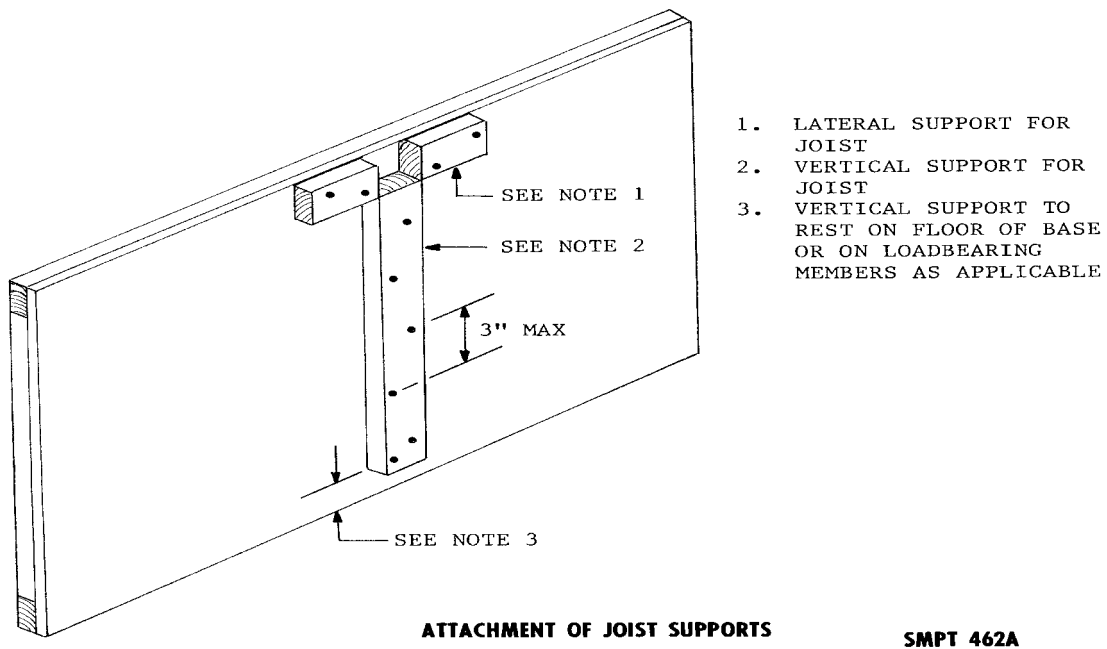


Figure 3-27. Attachment of joist supports for wood cleated, skidded, load bearing base boxes.

Assembly of the Base

Depending upon the weight of the item, load condition, size and length of skids, and whether it is a Class 1 or Class 2 base, the base parts are cut to size for fabrication. The nailing of plywood and lumber flooring to the skids is illustrated in figure 3-25.

Load bearing floor members over 2 inches thick and up to 4 inches in width are bolted to the skids with one carriage bolt at each end. Two carriage bolts are used at each end of load bearing floor members when they exceed two inches in thickness and 4 inches in width. The load bearing floor members are fastened to skids with 3/8-inch carriage bolts. Load bearing members less than 2 inches in thickness are nailed to the skids. Nails shall be as large as practicable without splitting the piece. The end headers are fastened to the skids with 3/8-inch carriage bolts.

Assembly of the Superstructure

The assembly of the cleated plywood, cleated fiberboard, and cleated paper-overlaid veneer panels into the superstructure shall comply with the applicable requirements of the specifications already described.

Assembly of the Superstructure to the Base

The end and side panels are assembled to the base with lag bolts (sometimes referred to as "lag screws"). One 3 inch lag bolt, three-eighths inch in diameter, is placed through the lower longitudinal cleat of the side panel and into the skid, at a distance not less than 2 inches from the end of the cleat. The distance between additional lag bolts shall not exceed 12 inches. In attaching the end to the header, one lag bolt is placed through the lower filler and into the end header, at a distance not less than 2 inches, not more than 3 inches from the end of the filler cleat. A minimum of two lag bolts are required through each end filler cleat.

CAUTION

Lag bolts shall not be driven with a hammer except to start them. They shall be turned in their holes the full distance. If the threads become stripped in the wood, the lag bolt is to be removed and inserted in a new hole near the old position. A washer is placed under the head of each lag bolt. Countersinking of lag bolts is not permitted.

WIREBOUND WOOD BOXES (PPP-B-585)

A wirebound wood box is a resilient engineered structure deriving both strength and economy from the substitution of steel wires for a considerable portion of wood. The sides, top, and bottom of this container are stapled to several binding wires and are fastened to a framework of cleats at each end by staples driven astride the end binding wires. The ends are nailed, stapled, or wired to the cleat framework to form the container.

Description of Box Components (fig 3-29)***Blank***

A blank is the assembled parts of a wirebound wood box. The wood faceboards of the box are held together by wires which are stapled to them. Blanks are "set up" to form a box.

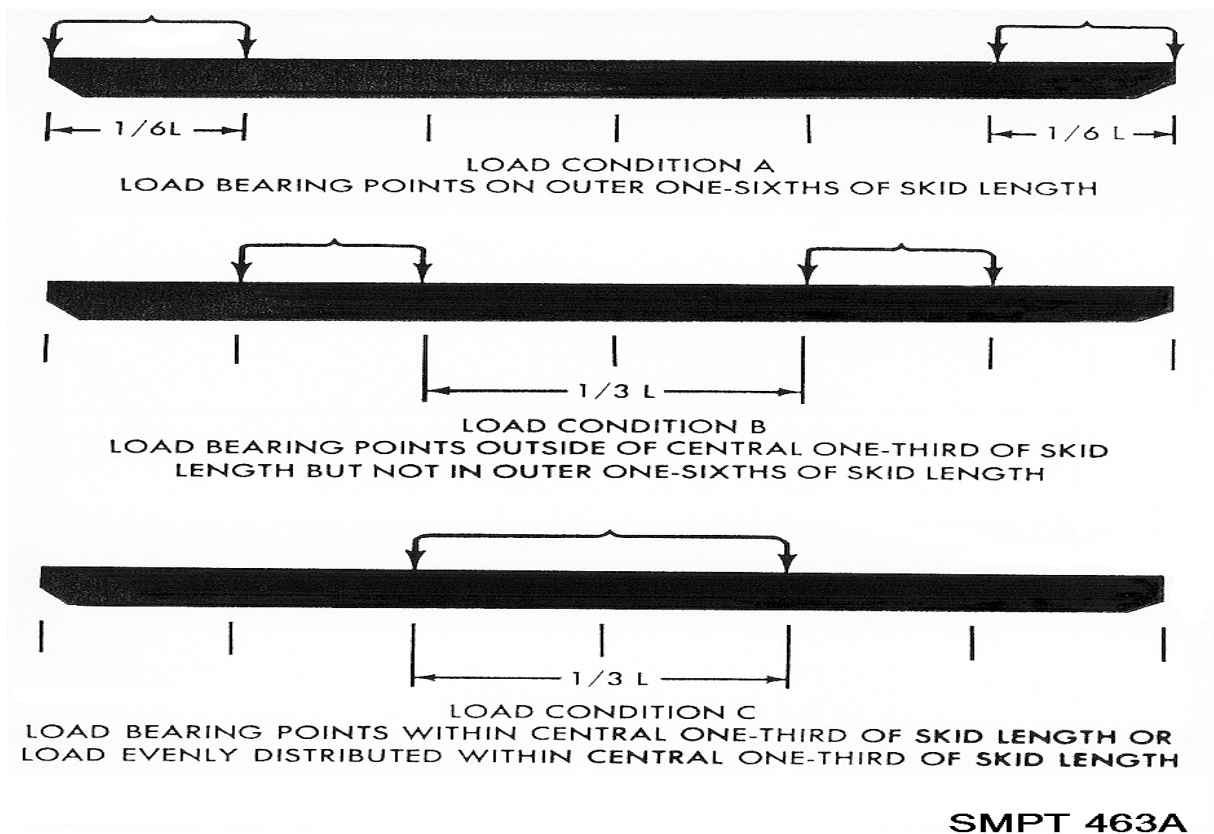


Figure 3-28. Load distributions of skids.

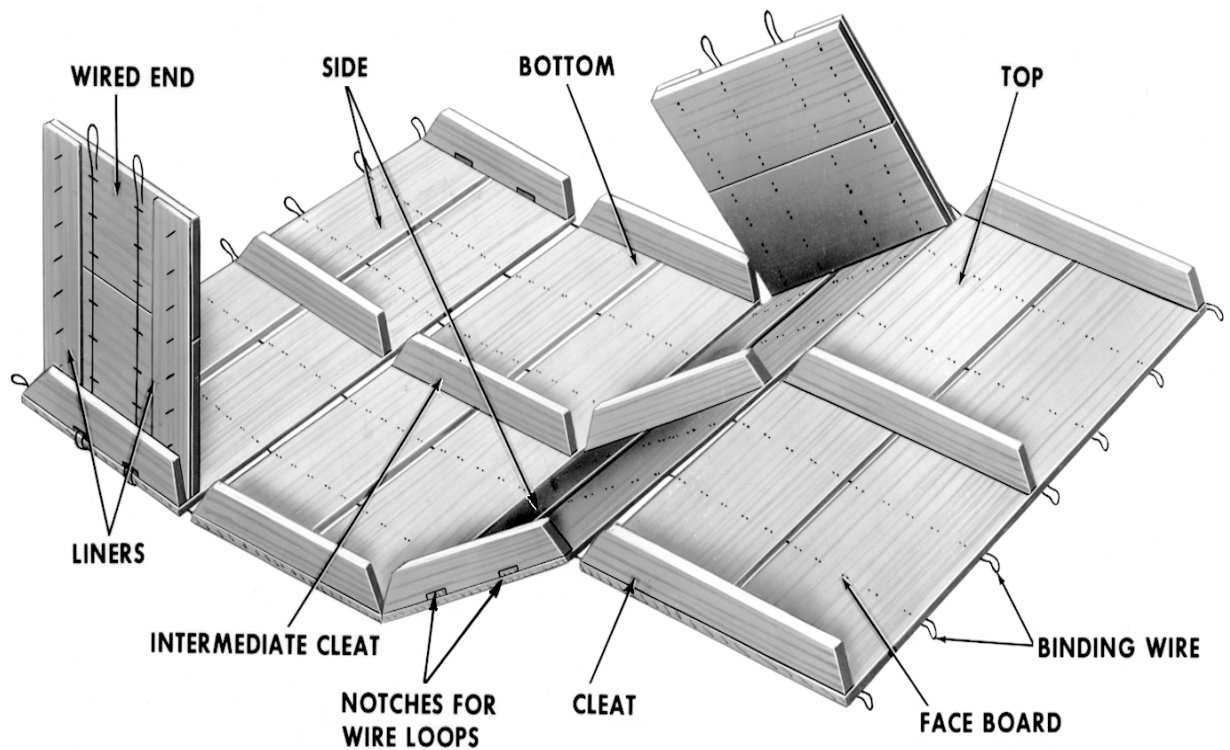


Figure 3-29. Components of wirebound wood boxes.

Cleats

Cleats form the framework to which the ends of the faceboards or slats are fastened. They are made with mitered or mortised and tenoned ends (tongued-and-grooved). Intermediate rows of cleats may be required to reinforce unsupported spans.

Faceboards

Faceboards are the thin boards that form the six faces of the box. They are made of veneer, resawn lumber, plywood, or paper-overlaid veneer. Their chief function is to hold the contents of the box in place.

Binding Wires

They hold the faces of the box together and carry most of the weight in the box.

Staples

They hold the faceboards and cleats to the binding wires.

Ends

The ends may be either plain, lined, or battened, according to the type of materials used, the weight of contents, and type of load. Only ends made from plywood are plain.

Battens

They are pieces of wood used on the ends of wirebound wood boxes to reinforce the ends, to reinforce the cleats, and to increase the strength of the box so that it may carry heavy stacking loads.

Liners

They are thinner pieces of boards stapled to the ends in order to tie all parts together and to strengthen the fastening section. The grain of the liner is placed at right angles to the grain of the end faceboard. They are stapled to either the outside or inside face of the ends. Liners for Styles 1 and 2 boxes are always vertical; liners for Style 3 boxes are always horizontal.

Skids

A wirebound box has two skids added when it carries a gross weight in excess of 200 pounds or when the gross weight exceeds 100 pounds, but the length and width are 48 inches by 24 inches or more. Additional skids are added if the distance between them exceed 48 inches. They are secured by two rows of nails in a staggered pattern. PPP-B-585 stipulates other requirements concerning the addition of skids.

Classes

Class 1 Domestic

For domestic shipments not involving sea transportation, but subject to storage, rehandling, or reshipment to domestic destinations. Weight limitation is 500 pounds.

Class 2 Normal Oversea

For off-shore and oversea shipments contemplating projected storage and commercial-type handling. Weight limitation is 400 pounds.

CLASS 3 MILITARY OVERSEA

For oversea shipments and handling in military supply systems, subject to repeated rehandling and unprotected storage, and which may also be subjected to extreme climatic conditions. Weight limitation is 300 pounds.

If required, Class 2 and 3 boxes are preserved with the same preservative treatment as PPP-B-621 and PPP-B-601 wood boxes.

STYLE OF BOXES

Three styles of wirebound wood boxes are used for domestic and oversea shipments. These styles differ primarily in the manner of closure of the binding wires. Each style can be easily recognized in figure 3-30. Style 1 has a twisted wire closure, Style 2 has a looped wire closure, and Style 3 has a looped wire closure and has the ends reinforced with wire instead of battens. Unless end battens are used, the Style 3 box is not recommended for Type 3 (difficult) loads.

ORDERING DATA

Wirebound wood boxes are engineered and manufactured commercially and are not made locally by military activities. Procurement documents should include the specification number (PPP-B-585); the inside length, width, and depth to the nearest one-sixteenth of an inch; the style of box; the class of box; the type of load; and the weight, quantity, and marking of the contents. If blocking or bracing is required, it is suggested that a drawing or a sample of the item be furnished to the box manufacturer.

CONTAINER MANUFACTURER'S IDENTIFICATION

Unless otherwise specified, each box is imprinted with the following information, which is limited to 15 square inches and placed in a lower corner of one side panel:

- Federal Specification PPP-B-585.
- Box manufacturer's name.
- Plant location.
- Maximum weight of contents...pounds.
- Class...box. For type...load. Style...Box.

BOX USAGE

Each box is manufactured to do a specific job. When used for the proper maximum weight of contents, type of load, and class of use, it will afford adequate protection to the item being shipped. It is important that the container manufacturer's identification be utilized prior to packing. The following points must be considered:

- In using the boxes, care should be exercised to select the box designed for the type of load to be shipped. A Type 2 load will not be packed in a box designed to carry a Type 1 load, and a Type 3 load will not be packed in a box designed to carry either a Type 1 or a Type 2 load.
- Type 1 and 2 loads, the inside dimensions of the box will be sufficiently exact so that the contents fit snugly into the box and give support to all its faces.
- Type 3 loads, other than bulk loads, the contents will be firmly bolted, blocked, braced, or otherwise anchored to the frame of the box in such a manner that shifting of the contents will not occur during handling of the shipment.

ECONOMY FACTORS

Wirebound wood box contains approximately one-half as much lumber as a nailed wood box of the same size which carries the same amount of contents. Wirebound wood boxes are usually available at a lower price than many other shipping containers of more rigid construction.

Style 3 boxes are resilient on all six faces. Items requiring this characteristic in the box can use a Style 3. Style 3 boxes are the most economical of the styles. The original cost of the box is less than that of the other styles. The savings of time in setting up the boxes is advantageous. Since the amount of lumber in a wirebound wood box is greatly reduced, compared to other types of wood containers, the tare weight is lower. Accordingly, the freight charges on a given size shipment are correspondingly lower. There is a saving in labor operations due to the simplicity of assembly and the ease of closure.

Styles 2 and 3 boxes can be opened and reclosed at intermediate stages of distribution much easier than other kinds of containers.

Wirebound boxes can be repaired and reused.

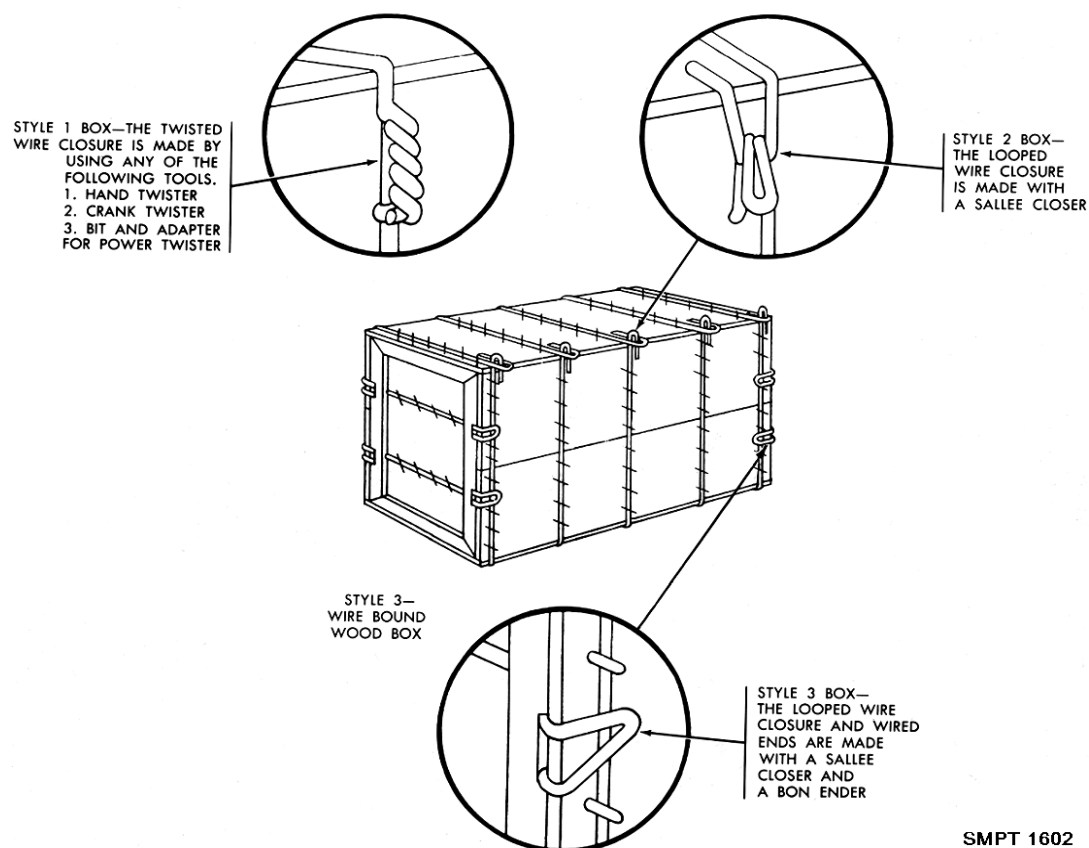


Figure 3-30. Styles of wirebound wood boxes.

SETTING UP THE BOXES

Boxes arrive from the manufacturer in a knockdown condition and are stored knockdown until the time of use. Each box is then set up prior to loading of shipment. The method of setting up depends upon the style of the box.

Setting up of Styles 1 and 2 (fig 3-31)

Lift the sides of the blank slightly before folding. Fold the box by raising the sides at right angles to the bottom. Fasten the ends to the side cleats using a steel nailing table or an end stapling machine. Ends are fastened to side cleats by either staples or cement-coated and chemically-etched nails. Unless otherwise specified, staples for Class 3 use boxes are galvanized. The length of each fastening will be not less than the thickness of the end boards plus three-quarters the thickness of the cleats or battens. The points of the fastenings will not protrude from the cleats or battens, but, if driven through, they must be clinched. The average spacing of the fastenings will not exceed 2 1/2 inches.

Drive sevenpenny cement-coated or chemically-etched cooler or sinker nails through side cleats into adjacent battens and through bottom cleat into intermediate batten. Boxes having both vertical and horizontal battens adjacent and parallel to cleats should be fastened by nailing through bottom faceboards and cleats into the battens only. The spacing of nails driven into adjacent battens will not exceed 5 inches.

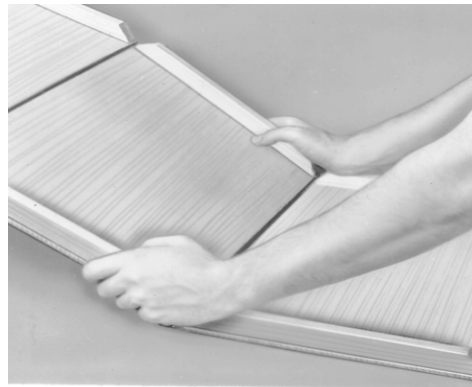
Setting up of Style 3 (fig 3-32)

Bend up looped end wires of ends using the hollowed end of a bon ender. Lift sides of the blank slightly before folding and raise sides at right angles to bottom. Pass the bent end loops through notches in the cleats. Using the tapered end of the bon ender, bend back the looped wire over and around the binding wire of the side.

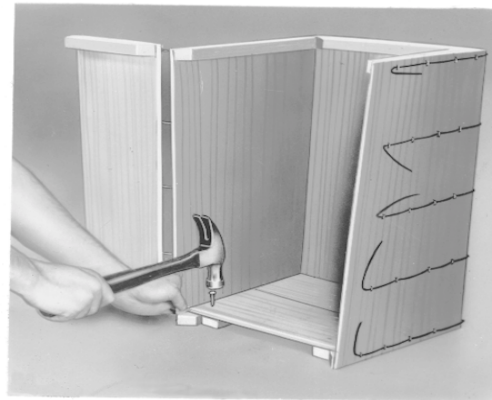
When battens are used on the ends of style 3 boxes, battens adjacent to batten cleats are nailed by driving sevenpenny cement-coated or chemically-etched cooler or sinker nails through the bottom boards, through the cleat and into the adjacent batten. Spacing of nails will not exceed 5 inches. Intermediate battens are secured by driving one sevenpenny cement-coated or chemically-etched cooler and sinker nail through the board and cleat into the end of the intermediate batten.

Strapping Requirements

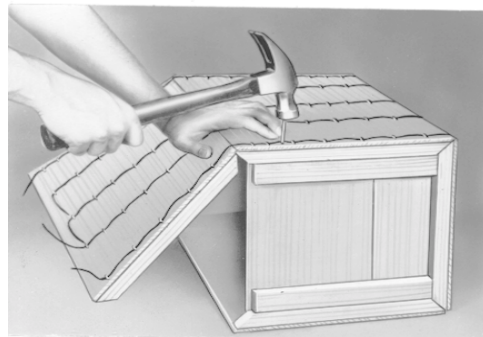
Where strapping is required, the top cleats shall be brought in contact with the side cleats and the strapping is applied before the wires at the closing edges are twisted or looped. This eliminates occasional slack which may develop when strapping is applied after closure is made. Strapping is placed as indicated in figure 3-33 wire strapping cannot be smaller than 13-gauge. Flat strapping cannot be less than 5/8 X 0.020 inch.



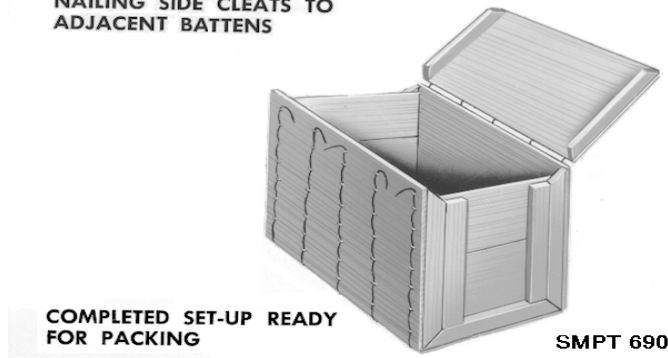
**FORM BOX BY RAISING SIDES
AT RIGHT ANGLES TO BOTTOM**



NAILING ENDS TO SIDE CLEATS



**NAILING SIDE CLEATS TO
ADJACENT BATTENS**



**COMPLETED SET-UP READY
FOR PACKING**

SMPT 690

Figure 3-31. Setting up of styles 1 and 2, wirebound wood boxes.

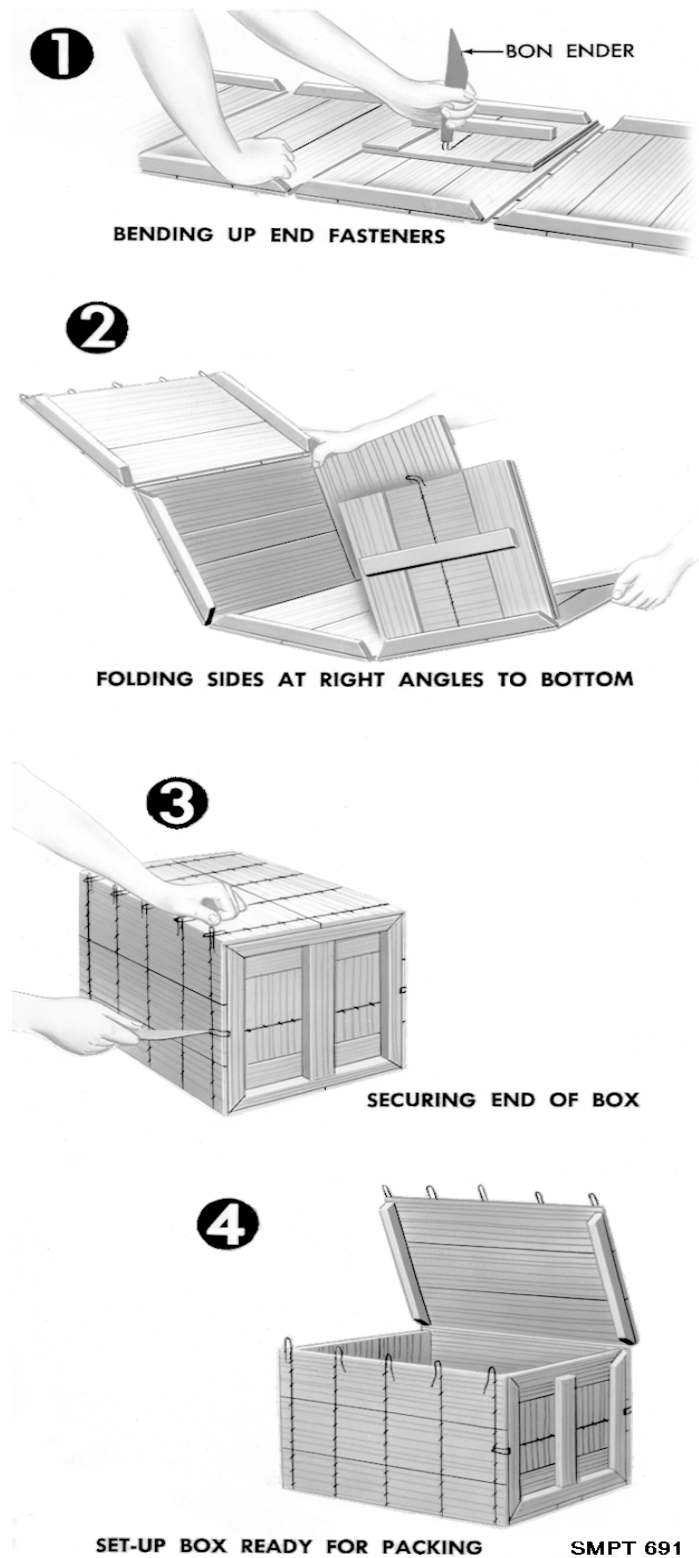


Figure 3-32. Setting up of style 3 wirebound wood box.

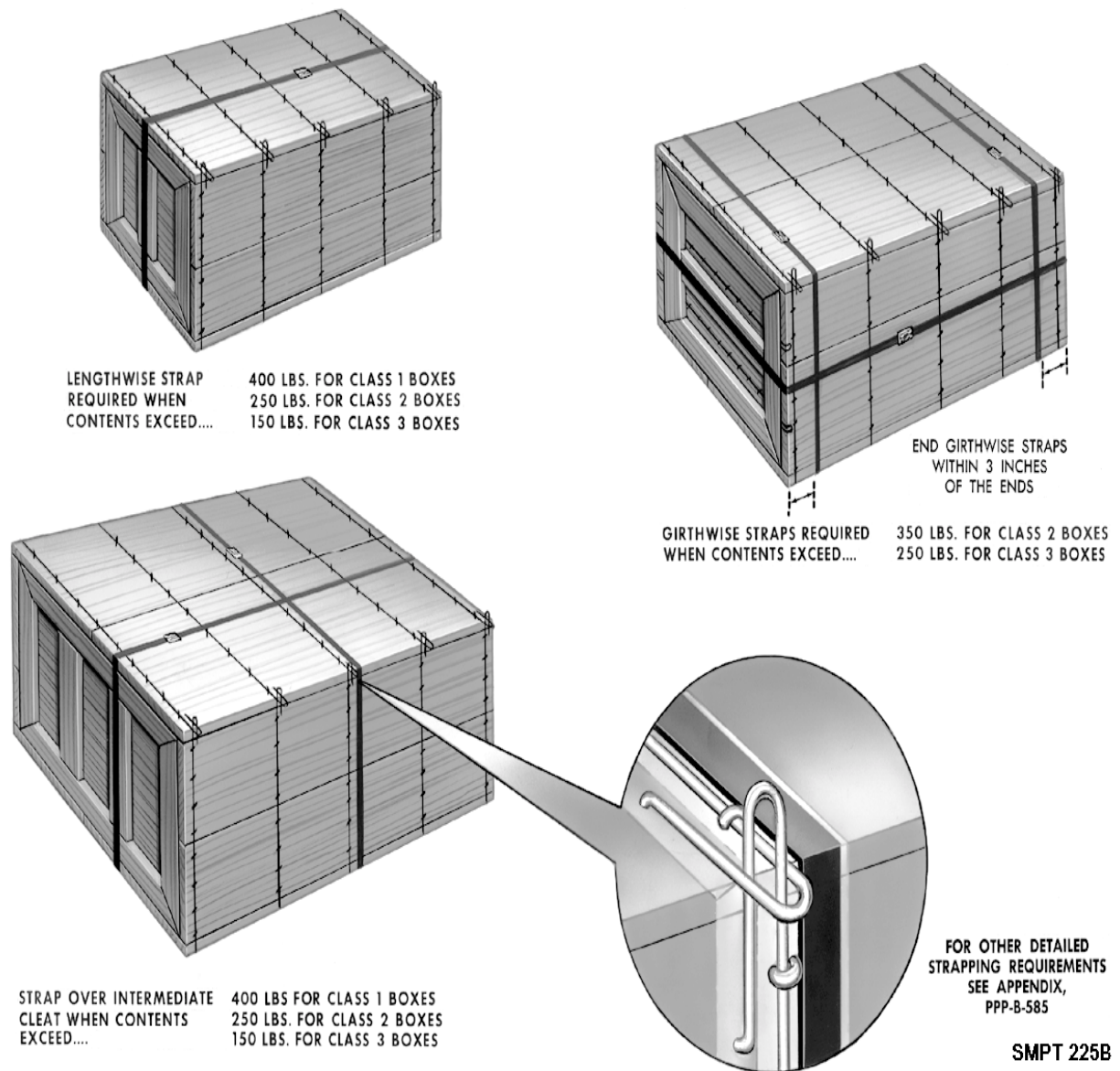


Figure 3-33. Strapping of wirebound wood boxes.

Closure of the Boxes

Closure of Style 1

Style 1 boxes are closed by using special tools (fig 3-34). When intermediate battens are used on the ends of the box, one sevenpenny cement-coated or chemically-etched sinker or cooler nail is driven through the top board and cleats and into the end of each intermediate batten. This is done prior to making the closures of the binding wires.

Closure of Styles 2 and 3

These styles are closed by using a Sallee closer. Perform the steps, as shown in figure 3-35. Insert the Sallee closer through the side loop and catch the top loop in the notch on the end of the tool. Raise the handle of the Sallee closer to slightly beyond a vertical position and push the top loop down against the side of the box. Complete closing by swinging the handle of the Sallee closer down

as far as possible. Drive a nail through the top cleat into each intermediate batten. Do not nail into the ends of the battens that are adjacent to the cleats.

Note. The applicable tools for making closures are illustrated in figures 3-34 and 3-35. Correct tools are available from box manufacturer. Do not use screw drivers, pliers, etc., because an adequate closure cannot be made and their use is time-consuming and may be a safety hazard.

PALLETS (GENERAL)

DESCRIPTION

A pallet is a portable platform on which material is placed to facilitate handling and transportation. This platform is generally a two-deck structure which permits mechanical handling and tiering of unit loads of supplies and equipment.

Types of Pallets

Pallets are classified as expendable and permanent. They are also classified as general purpose and special purpose.

Expendable Pallets

Expendable pallets are designed generally for one shipment and then discarded. Their construction is usually of wood, fiberboard, or a combination of the two. In order to be effective as one-trip pallets, they must be lightweight and low in cost. When the cost of using them is equalled or exceeded by the savings realized during a single trip, they are truly expendable pallets. Examples of expendable pallets are illustrated in figure 3-36.

Permanent Pallets

Permanent pallets are termed as general purpose and special purpose pallets.

General Purpose Pallets

The general purpose pallets are constructed of hard wood and are normally 40 inches by 48 inches in size. They fit economically into railroad and, motor vehicles, and trailers. Two general purpose pallets are the 4-way entry post pallet and the 4-way (partial) four-stringer pallet (fig 3-37).

Special Purpose Pallets

Pallets made of metal, which are suitable for certain heavy duty usage, are special purpose pallets. They are more rugged and will stand more abuse than wood pallets. There are no fasteners to work loose and cause damage to flexible containers and their contents. Pallets made of aluminum have been developed that are light in weight. The initial cost of metal pallets is high in comparison to pallets made of wood.

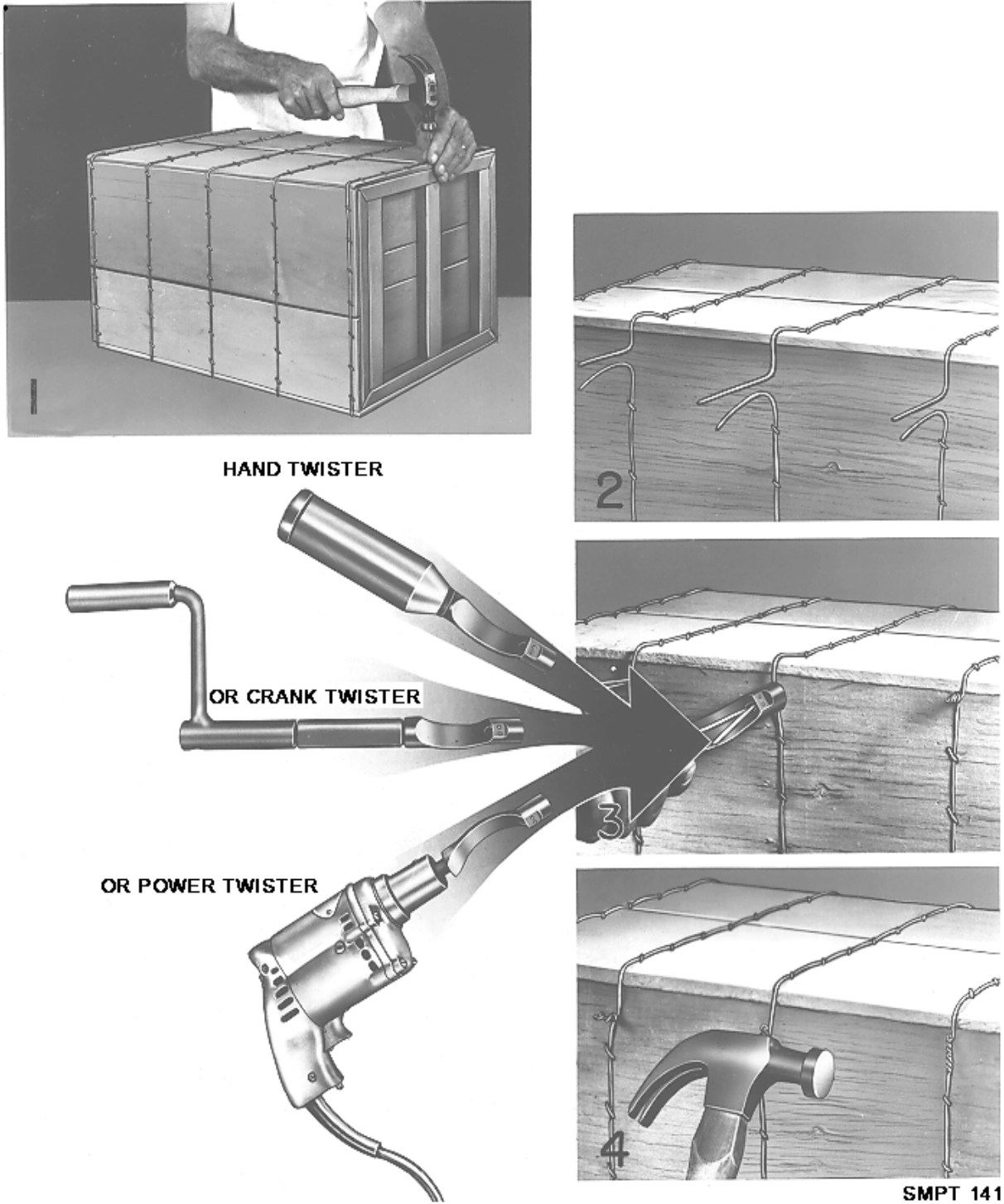


Figure 3-34. Closing of style 1 wirebound wood box with special tools.

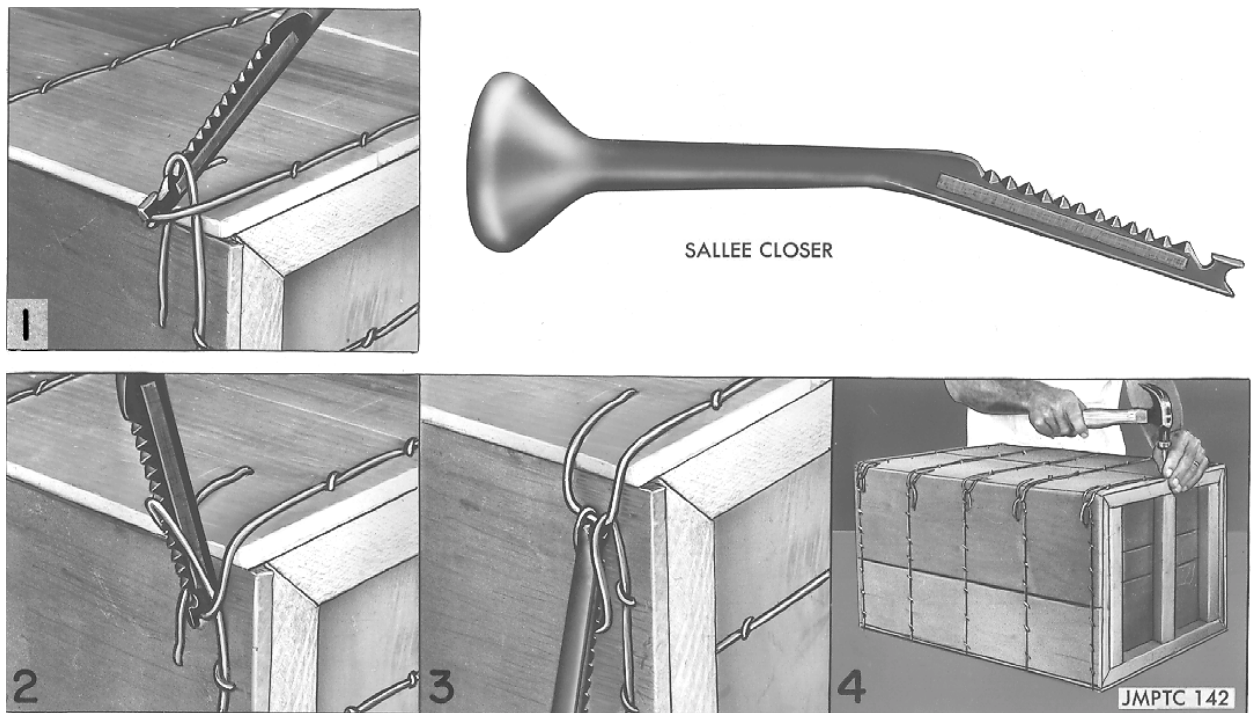


Figure 3-35. Closing of style 2 and 3 wirebound wood boxes.

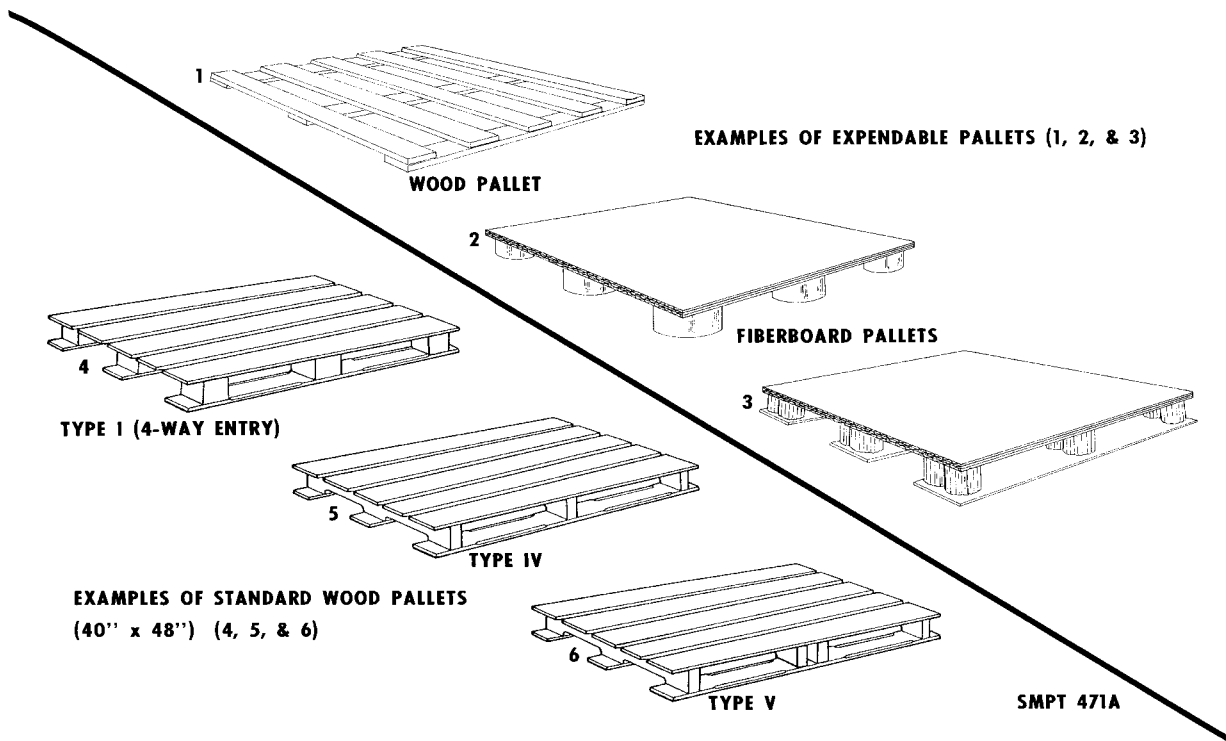


Figure 3-36. Examples of expendable pallets.

FOUR-WAY POST CONSTRUCTION PALLETS (MIL-P-15011)

These pallets are available in two types: Type I (assembled) and Type II (unassembled). Each type is available in two classes: Class 1 (seasoned lumber, 22 percent maximum average moisture content); Class 2 (Unseasoned lumber, unspecified moisture content). There are four styles. Style 1 is the general storage pallet and is of the standard 40 inch by 48 inch size, and unless otherwise specified, is constructed of high density wood. Style 1A pallets are constructed the same as Style 1 pallets except that the size is 35 inches long by 45 1/2 inches wide. The smaller, Style A1 pallets are designed for better utilization in intermodal transporters and the fourth style, style 2 is a light-weight, air cargo pallet, 40 inches by 48 inches in size. It is constructed of the low or medium density woods with thickness less than that for Styles 1 and 1A. These pallets provide full 4-way entry to materials handling equipment. As indicated in figure 3-37 nine posts are placed on the bottom boards with drive-screw nails conforming to Type II, Style 18, of ASTM F 1667-95. Stringers extending the length (40 inches, Styles 1 and 2 and 35 inches for Style 1A and 42 inches for Style 1B) of the pallet are fastened to each row of posts. The deck boards are nailed through the stringers and into the posts. Style 1B pallets are constructed the same as Style 1 pallets except that the size is 42 inches long by 53 inches wide.

FOUR-WAY (PARTIAL) STRINGER CONSTRUCTION PALLETS (NN-P-71)

Two-way and four-way stinger pallets are available in several types and may be assembled or unassembled (fig 3-37). Each type is available in various sizes. They are used wherever two-way or partial four-way entry is required by conventional materials handling equipment. Four stringers made from 2 inch by 4 inch lumber are nailed or bolted at right angles to the bottom deck boards. The stringers are cut out to enable fork lift entry. The top deck boards are nailed to the stringers.

MAINTENANCE OF PALLETS

Wooden pallets are susceptible to damage and must be kept in constant repair. Broken or split deck boards must be replaced when their holding power is impaired. Fastenings that work loose should be carefully repaired. When nails must be replaced, snip off nail heads and drive into stringer or block. Make sure that new nails do not line up with previously occupied nail holes. It is recommended that a stock of repair parts be available for making all repairs.

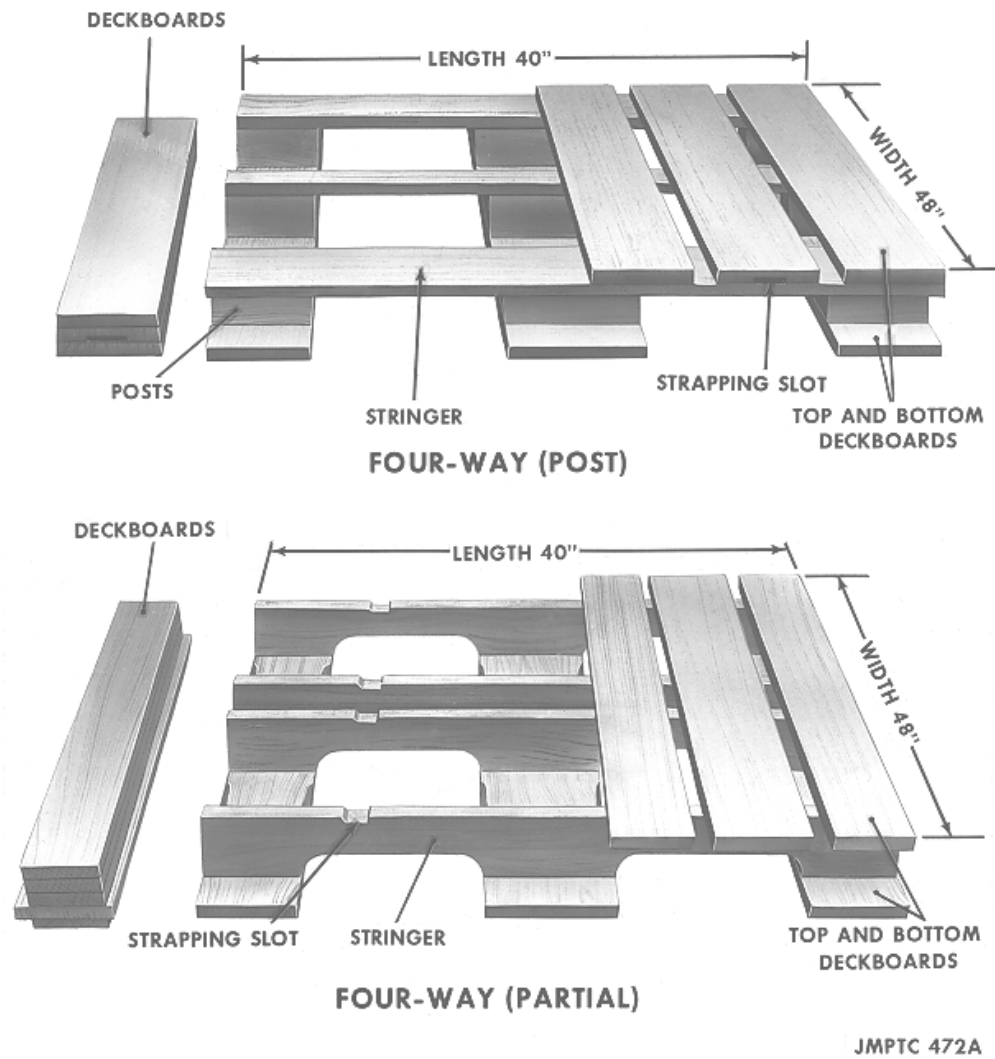


Figure 3-37. Four-way entry post and (partial)four-stringer pallets.